

viously noticed, were found in the earlier sweeps. Later sweeps in the same part of the heavens have not added to the list, although many known nebulae and red or variable stars have arrested attention. On September 22 Comet Wolf was found by its spectrum, twelve hours before the news of its discovery had reached Dun Echt, the announcement having been accidentally delayed in the telegraph office at Kiel.

The places of the five objects are :—

R.A. 1884.			Decl. 1884.			When found.		Remarks.
h	m	s	°	'	"	1884.		
20	5	9.82	+ 16	34	53.3	Sept.	17	Equal in brightness to a star 10.2 mag. Diam. <i>n</i> and <i>s</i> 4".6 by micrometer. It has an 11 mag. star at 222° 27', distant 84".2.
20	6	44.09	+ 46	7	2.3	Sept.	20	Planetary nebula ; most of the light in a single line.
20	7	33.43	+ 19	38	30.4	Sept.	17	Nebula about 2½" diam., equal to a 9.8 mag. star. Follows η <i>Sagittæ</i> 7 ^m 32".77, 61".15 to the south.
20	7	52.99	+ 38	0	26.8	Sept.	22.	This is the 7.1 mag. star, D.M. + 37°.3821. It has a spectrum of several bright lines near D, and a very bright band in wave-length 464 ^{mm} . The place is from B.W.2.
20	9	40	+ 12	23	3	Sept.	22	This seems to be identical with the 9.5 mag. star D.M. + 12°.4266. It is in reality a planetary nebula about 4" in diameter with a nearly mono- chromatic spectrum.

The fourth object is probably the most interesting of the series. It is practically a member of the same group as the three stars of the same type found by Messrs. Wolf and Rayet to which Professor Pickering has added a fourth. This is the brightest object of its class in the northern heavens. It is intended to examine its spectrum shortly with improved appliances.

Dun Echt :

1884, Dec. 11.

An Occulting Eye-piece. By Edmund J. Spitta, M.R.C.S.
Eng., L.R.C.P. Lond.

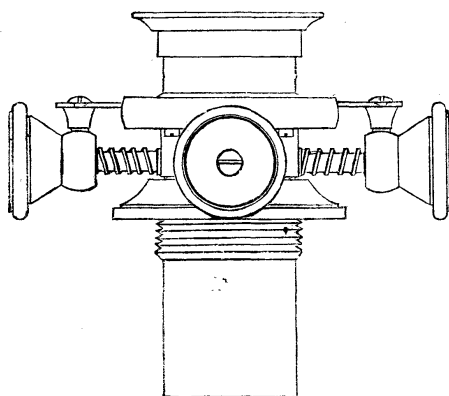
This arrangement consisting essentially of a shallow cylindrical brass box containing four shutters, placed in front of a tube carrying the lenses, is convenient in construction, and when screwed in to the telescope in place of an ordinary eye-piece, does not interfere with the comfort of the observer, is easily under his command, and not weighty enough to require a counterpoise.

The box containing the shutters, about a quarter of an inch deep, and one and a half in diameter, is pierced at its circum-

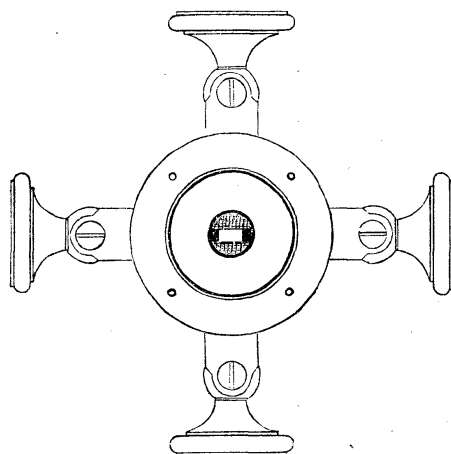
ference by four dove-tailed grooves, planed to allow the "carriers" of the shutters which run in them to move smoothly and regularly to and fro. Attached to the outer end of each carrier, at right angles, is a gun-metal pillar, perforated to hold the milled-headed screw—60 threads to the inch—the observer uses to close or open the shutters, whilst at its central end, that really within the confines of the box itself, is attached the shutter, its occulting end being "knife-edged." Great difficulty was experienced at first in making the four shutters meet in the field without catching against one another, and yet to keep all four in focus. At length this was overcome by bending two opposite ones deeply, the occulting edges being only in the focus, and allowing the others to pass to and fro within the curves of the former two. All are now in focus, and there is no fear of collision.

If one of the screws be turned in the ordinary direction, the corresponding shutter is pushed forward, and the field in that part is gradually occulted, whereas if all four be employed it will be reduced to a four-sided, right-angled figure. By further manipulation it can be shaped into a slit like that of the spectro-scope, or minimised still more until it becomes a mere pin-hole.

The lenses, Ramsden's construction, are placed in the cylinder, fixed to the shutter-box, and each is adjusted for its own focus of the shutters—powers 120 and 200 on a 6-foot. Three caps to this cylinder are provided, one with a small and another with a large eye-hole for small or large fields, and a third fitted with tinted glass which screws on the other two for viewing the Sun.



Side View with Sun Cap.



Viewed from above. Lenses and Cap removed showing Occulting Shutters.

The uses for which this instrument may advantageously be employed are as follows: Occulting bright stars whilst examining the fainter ones around; * the planets whilst viewing their

* In using this instrument the observer must bear in mind that it takes an

satellites, especially those of *Jupiter* in transit; portions of the Moon, the details thus shown being sometimes very striking; Sun spots or their nuclei, no diagonal being needed if the observer screws up the shutters very close before looking through the telescope; searching for comets or examining nebulae and clusters.*† As no clock is required for this instrument, and as all the shutters are at right angles to their neighbours, position angles can be very shrewdly calculated. To do this let the major star run along the edge of one or other shutter by turning the whole instrument on its axis, and bring a neighbouring shutter into the field. As the ordinary circular field is now reduced to an arc of 90° the Pos. Angle can much easier be guessed.

Due thanks must be accorded to Mr. Mason, the optician, who resides in my neighbourhood, for his great ingenuity and patience in perfecting many manufacturing details in this contrivance, and to Mr. Wray, jun., who especially designed the deep positive eye-pieces suitable to my requirements.

The Long Duration of Meteoric Radiant Points.‡
By W. F. Denning.

I have several times taken occasion to mention the very extended duration of a considerable number of the diverging centres of shooting stars, and the fact that there are successive recurrences of meteors from exactly the same points of the sky after short intervals of apparent quiescence. There are, however, grave mathematical difficulties to the view that such streams are physically associated. The fact of stationary radiants exhibiting visible activity during several months is a phenomenon so unaccountable and so utterly opposed to the approved theories as to the orbits of shooting stars, that it must receive a most crucial examination before it can be accepted. And the only applicable

appreciable time for the eye to recover the effect of the previous glare of the bright star; for that purpose it is well, I find, to keep the bright object some while behind a shutter before attempting to dismiss the field as barren. After a steady gaze a small star near *α Sagittæ* was observed Sept. 12 distinctly with the occulter, but *not visible* with my aperture (10 inches) whilst employing ordinary means. We judged its P.A. 180. Mr. Burnham wrote to the *Eng. Mech.* some weeks after to say he had discovered it with the great instrument he uses. He judged P.A. 180.5 with his micrometer.

* By loosening a small screw in the corresponding milled head of two of the shutters, they can be removed at once, and a blot or specially designed device easily substituted. This, it has been suggested, would be required for celestial photography in using the double printing process in conjunction with the occulter.

† It is worth a passing note that in using the occulter on clusters, the colours of particular stars are *much* better observed when neighbouring luminaries are absent. The contrast with and without the use of the shutter is very striking.

‡ For references to this question see also *Monthly Notices*, vol. xxxviii., pp. 111, 115, and 351.